MONITORING SYSTEM FOR REAL TIME FUEL TRANSPORTATION

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Abstract— To deal with the problem of monitoring and leak detection in fuel transporting vehicle, a GPRS-based (GPRS: general packet radio service) monitoring and leak detection system is developed. This system includes leak detection devices and a server system including database and monitoring software. Real time monitoring includes tracing location of fuel transporting vehicle, loading of fuels, amount of delivery of fuels, temperature, weight variation in the fuel transported etc.. The detection devices generally include, sensors and mainly controlled by a microcontroller (PIC16F873A). The gas leakage is detected by MQ-6 sensor, then the detected signal is transferred to system server through GSM modem (sim900). Through this application, the detection device is proved to have the characteristics of low power, long life and high sensitivity, as well as to perform well in online-monitoring and regarding the leak detection. It displays information regarding how much amount of gas is leaked. It incorporates the location detection feature (ie the location of vehicle transporting gas…) for the gas leakage area with the use of a GPRS, which comes with added feature of web interfacing by using some codes in the microcontroller programming.

Keywords— GSM modem (sim 900), GPRS, PIC16F873A, MQ-6 Sensor

I. INTRODUCTION

Gas leakages are a common problem in households and industries. If not detected and corrected at the right time, it can also be life threatening. Bhopal gas tragedy was an example of gas leakage accident in India. This was world's worst gas leakage industrial accident. And in the recent years too we have come across a number of gas tragedy. In such a case the need for a monitoring system for real time fuel transportation vehicles becomes necessary. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm, the idea behind our solution is to provide a cost effective and highly accurate system which ensures continues real time monitoring of fuel transportation vehicles. In addition to this, a message is sent to an authorized person informing him about the leakage. GSM module is used which alert the user by sending regular reports on fuel transportation .A GPRS shield is used to trace the location of the fuel transporting vehicle. In order to provide high accuracy an MQ-6 gas sensor has been used. This system includes leak detection devices and a server system including database and

monitoring software. Real time monitoring includes tracing location of fuel transporting vehicle, loading of fuels, amount of delivery of fuels, leakage of fuel if any, the amount leaked etc. Periodic reports are generated based on this analysis.

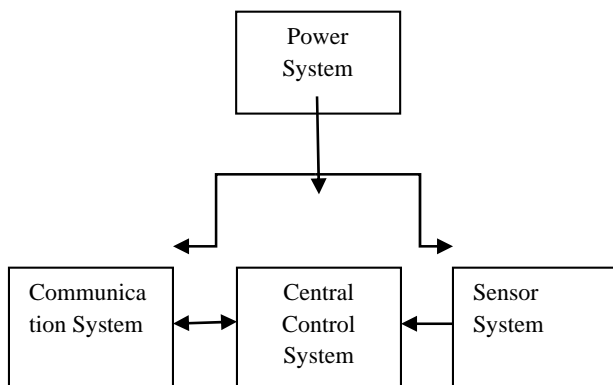## II.SYSTEM STRUCTURE

A .Basic Structure of System

Fig. 1: Basic Structure of system

Basically the system is composed of server system, central control system, communication system, sensor system and power system. The system structure is shown in Fig.1

i)**Communication System:**System can communicate with remote server through GSM modem(sim900).A GPRS shield which traces the location of the fuel transporting vehicle also communicates with the remote server.The amount of gas being transported,the delivered amount,leakage amount if leak detected are all communicated to the server periodically.

ii)**Sensor System:**Sensor system is composed of fuel level sensors , i.e.MQ-6 sensor.It detects leakage of fue l if any.

iii)**Power System:** The central control system is powered by DC power supply with the proper specifications.The communication system ie,GPRS system and sensor system are also powered by this power supply.

iv)**Central Control System:**This is the heart of the monitoring system.It consists of microcontroller with appropriate interfacing with other devices.It performs all the control actions required for proper operation of all the systems.

v)**Server System:** It is the sever that receives all data and stores the data .Associated with it is the monitoring software which is programmed using .NET in Visual studio and SQL SERVER.It has functions to analyse the data,display the data,generate various report forms as per the request,send real time reports etc.

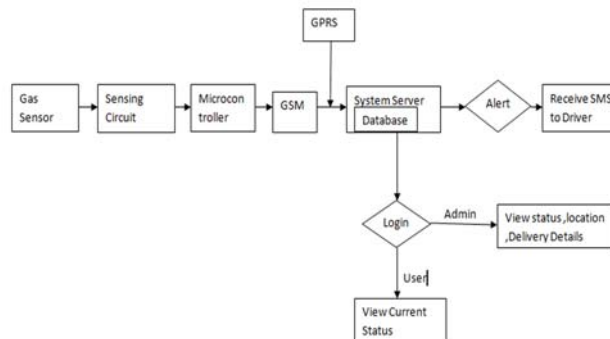### B. Structure of the Unit and its Implementation

Fig.2 Flow chart of the system

The sensing unit is placed inside the vehicle to sense the fuel level at various time instances and it also tracks the vehicle location with help of GPRS. To achieve these things the system is equipped with MQ-6 sensors along with signal conditioning circuits and microprocessor as main building blocks of our system.The sensing circuit of the gas sensor requires a DC power supply of 5 volts and a load.The output voltage is fed into a microcontroller(PIC-16F873A) and it is digitized using an 8-bit analogue to digital converter(ADC).The microcontroller reads voltage from the sensor and uses it to calculate change in concentration of gas.
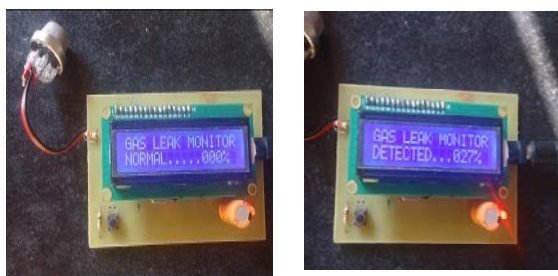
Fig.3.a Normal Mode   **3.b Leakage mode**

The gas sensor is mainly sensitive LPG and methane.Under normal conditions,the microcontroller starts with a caliberation stage,ie here it reads the sensor voltage under normal conditions and considers it as zero value.The microcontroller continuosly reads the voltage from the sensor and compares the value with the caliberated value.If the reading exceeds the threshhold value,the microcontroller generates a message leak detected and sends it to the central server system.It also shows the amount of gas leakage detected.

Controller coding is compiled in MPLABIDE v8.92 with HI-TECH ANSI C compiler and simulated in Proteus software which can be easily developed in hardware system.
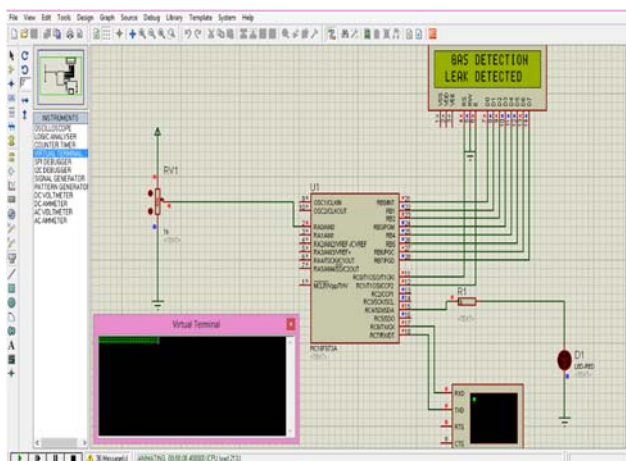

Fig.4 Simulation model for gas leakage detection

Proteus 7.0 is a Virtual System Modeling(VSM) that combines circuit simulation,animated components and models to co-simulate the complete microcontroller base designs.This is the perfect tool to test the designs before constructing a physical prototype in real time environment. It allows users to interact with the design using on-screen indicators such as LED and LCD displays and,if attached to the PC,switches,buttons,etc.Proteus 7.0 is the program to use when you want to simulate the interaction between software running on a microcontroller and any analog or digital electronic device connected to it.Fig.4 represents the simulation model of Gas leakage detection sensor which is interaced with PIC16F873A microcontroller and data is processed and transmitted to the client through GSM shield. The amount of fuel being transported,the amount being delivered ,the amount leaked if any all these are measured and is reported periodically.This is done basically by using a weight detection system. The receiving module consists of the central server system.The central server system receives the message from the sensing unit and then the data is transmitted to a mobile or a smartphone.It is assumed that driver is a registered user and he can get to see the message on gas leakage.The admin as well as the driver who are authorised can see periodic reports on the fuel being transported such as the location of transportation,the amount of fuel being loaded,the amount of delivery,leakage if any, amount leaked etc.A GPRS shield can be used to trace the location of vehicle.The main interface of the software is as shown in Fig.5.

Fig. 3 shows the Gas Leakage sensor used to identify any Leakage and is configured and wireless communication data is monitored in terminal window.The data can also be viewed on the driver's smartphone.This smartphone will be having an application which displays the real time monitored data.It shows the message delivered to particular user that the leakage detected.It is also being designed as an application where in an authorised user can get all periodic reports on real time fuel transported by logging into the application.The application interface of the smartphone is as shown in the Fig.6.

Fig.5 Interface for   the monitoring software

Fig.6 Smartphone Receiving Alert

The working status of sensor is broadly classified into two cases as depicted in fig 3, which shows normal mode and leakage mode. Normal mode when there is no gases leakage in first step of data. Gas leakage mode when leakage is detected. The server system as shown in fig.5 receives all data and stores the data.Associated with it is the monitoring software which is programmed using .NET in Visual studio and SQL SERVER.It has functions to analyse the data,display the data,generate various report forms as per the request,send real time reports etc. The software interfaces for the system is as follows:

OPERATING SYSTEM	WINDOWS 7
WEB SERVER	I IS
FRONT END	ASP .NET
SCRIPTING	C#.NET
BACKEND	MICROSOFT SQL SERVER 2008
MICRO CONTROLLER(PIC16F873A) INTERFACE	C

III. RESULTS

A complete prototype system for monitoring system for real time fuel transportation was implemented as shown in Fig.3.The working of the system depends on continuosly monitoring the fuel being transported ,detecting the change in concentration of the fuel being transported and sending the reports to the server system as well as the mobile device.

The proposed system was tested by introducing a very small amount of gas using lighter.The sensor was introduced to the lighter after initial caliberation.The sensor was able to detect small amount of gas and messages were given to the server sysem.The GPRS shield could also trace the location.The operation range of the wireless system was also tested.And it was found that it

could work over a range of 22m for indoor and 110m for outdoor.

IV .CONCLUSION

This work represents a prototype to deal with the problem of monitoring and leak detection in fuel transporting vehicle.A GPRS-based (GPRS:general packet radio service) monitoring and leak detection system is developed. This system includes leak detection devices and a server system including database and monitoring software. Real time monitoring includes tracing location of fuel transporting vehicle,loading of fuels,amount of delivery of fuels,temperature,weight variation in the fuel transported etc.. The detection devices generally include,sensors and mainly controlled by a microcontroller (PIC16F873A).. The gas leakage is detected by MQ-6 sensor, then the detected signal is transferred to system server through GSM modem(sim900). Through this application, the detection device is proved to have the characteristics of low power, long life and high sensitivity, as well as to perform well in online-monitoring and regarding the leak detection.It displays information regarding how much amount of gas is leaked. It incorporates the location detection feature (ie the location of vehicle transporting gas…)for the gas leakage area which comes with added feature of web interfacing by using some codes in the microcontroller programming.

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